# GYPSUM and ANHYDRITE in NOVA SCOTIA

*by*

*G. C. Adams*

INFORMATION CIRCULAR
16

*Cover Photo: Gypsum and anhydrite cliffs, Thumb Hill, Hants County.*

*Inset: Radial stacker, National Gypsum (Canada) Ltd., Wright's Cove, Halifax County.*

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Nova Scotia Department
of Mines and Energy
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# GYPSUM AND ANHYDRITE

## Introduction

The word gypsum is derived from the greek "gypsos" meaning chalk. Anhydrite is merely gypsum without water. These minerals are formed through the evaporation of salt waters and are frequently found interbedded with limestone, dolomite and shale. Deposits of gypsum and anhydrite are found worldwide on all continents with the possible exception of Antarctica.

## USES OF GYPSUM AND ANHYDRITE

Approximately 75 per cent of the gypsum used in North America is "calcined", meaning that three-quarters of the water has been removed by heating to form stucco or plaster of Paris.

Calcined gypsum is one of the most common building materials in the world. It is used for interior wall partitions and ceilings, either as plaster or in prefabricated products. Regular wallboard and type-x wallboard with its fire-resistant characteristics make up over three-quarters of the market for calcined gypsum. Minor uses for calcined gypsum include dental plaster, modeling casts, moulds, surgical casts and drilling muds.

Uncalcined gypsum and anhydrite are used in much the same way. After crushing and grinding, their principal use is as a set retarder for cement. When a small amount of gypsum or anhydrite is added to Portland cement the set of the cement is slowed but the tensile strength is not lessened. Another important use is in the agriculture industry where gypsum and anhydrite have a beneficial effect on many crops. These additives neutralize alkaline and saline soils, improve the permeability of argillaceous materials and provide sulphur, calcium and catalytic support in order to decrease fertilizer use and maximize crop production.

Uncalcined gypsum is also used to a lesser degree as a filler in paints, as a flux in the smelting of certain nickel ores, in the manufacture of crayons, in asbestos packing gaskets and as a sculpture medium when in the form of alabaster.

Anhydrite has also been used as a filling and packing material in the coal mining industry in West Germany since the mid 1960s. Natural anhydrite is crushed to less than 7 mm (30 per cent of which is dust) then mixed with water and an accelerator ($Fe_2SO_4$ and $K_2SO_4$) to form quick-setting, high strength roadside packs. Aerated anhydrite products may also be used to fill in cavities in mine roofs or spaces above road arches.

## NOVA SCOTIA'S RESOURCES

Nova Scotia's gypsum and anhydrite deposits are among the largest workable deposits in Canada. Nova Scotia is the most productive gypsum mining region in the world. Gypsum outcrops throughout the whole of the northern half of the Province's mainland. Cape Breton Island also abounds with gypsum and anhydrite.

Areas in Nova Scotia underlain by gypsum or limestone often display a very rough terrain, having many pits and mounds. This karst topography is common even when the rocks themselves cannot be seen at surface and is a good indication of the presence of gypsum. The most commonly recognized

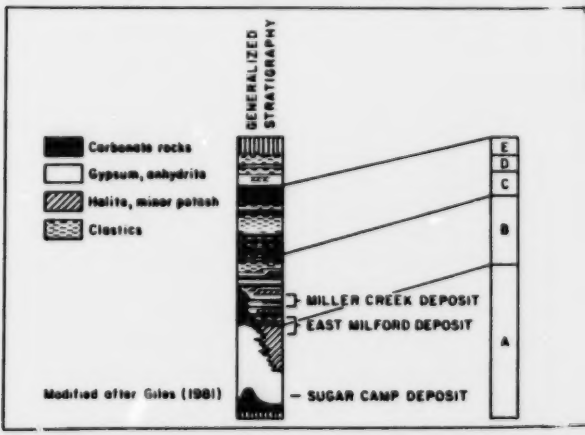



*Figure 1. Lithostratigraphy and major depositional cycles*

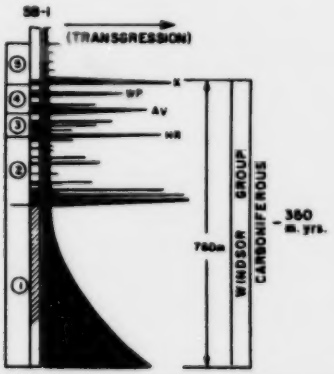
karst form is the sinkhole. Usually cone shaped and often partially filled with water, these can be seen in many places in Nova Scotia.

Virtually all Nova Scotia gypsum and anhydrite occurrences are of Carboniferous age (approximately 290-350 Ma), and occur almost exclusively within the stratigraphic unit known as the Windsor Group (Bell, 1929). The Windsor Group has five subzones, A, B, C, D, and E and the gypsum and anhydrite are closely associated with limestone and siltstone in all the subzones (Fig. 1).

Giles (1981) divided the Windsor Group into 5 cycles instead of subzones. Each of these cycles is characterized by one or more transgressive or regressive cycles. These cycles roughly correspond to Bell's (1929) subzones.

The majority of the sulphate evaporites were deposited in Cycle 1 which represents a single rapid marine invasion followed by a slow regression of the sea. Cycle 2 also represents extensive evaporite deposition, but consists of numerous transgressive-regressive sequences, all similar but on a much smaller scale than Cycle 1. Minor deposits of gypsum and anhydrite also occur throughout the 3 remaining cycles.

The gypsum and anhydrite deposits of economic importance are confined to the Lower Windsor Group Cycles 1 and 2. Cycle 1 is the most extensive with up to 300 m thickness of anhydrite.




*in the Windsor Group.*

Mineable gypsum sections in Cycle 1 appear to have been formed by the hydration of the upper surface of these thick anhydrite bodies. Although sometimes reaching thicknesses of over 50 m these deposits are generally only 10 to 30 m in thickness. Fault zones and geological contacts often allow gypsum to form at greater depths in the Cycle 1 anhydrites.

In Cycle 2, gypsum and anhydrite generally represent 80 per cent of the 75-150 m thick section. This section is usually contorted as a result of structural deformation which results in much deeper hydration and gypsum mining thicknesses of over 90 m. Along with this increased thickness, however, are increased volumes of interbedded limestone and siltstone, which must be removed from the gypsum ore before it leaves the mine site.

Several noteworthy occurrences of native sulphur have been found in the sulphates of the Windsor Group at Hilden, Colchester County, Pugwash, Cumberland County and Dingwall, Victoria County. Little effort has ever been made to search for sulphur in the Province.

## HISTORY OF GYPSUM AND ANHYDRITE MINING IN NOVA SCOTIA

The first mining of gypsum in North America was in Nova Scotia about the year 1770. Since that time, Nova Scotia has become the largest gypsum mining region in the world. The early producers were almost all farmers from the Hants County area who owned land where gypsum occurred. They quarried the rock and took it via horse and wagon to the nearest shipping terminal. There, the gypsum would be sold to local traders and shipped to the Eastern Seaboard of the United States for use as a fertilizer.

Realizing there was a good financial return to be made in the gypsum trade, the farmers became more serious about developing the business into more than just a part-time operation. By the early 1800s production in Nova Scotia had reached over 100 000 t per annum and stayed between 100 000 and 200 000 t for quite some time, fluctuating with the demand from the United States. The largest portion of Nova Scotia's gypsum was sent to the

United States, so that country's gypsum requirements controlled Nova Scotia's industry.

The development of quarries in Cape Breton began in 1856 as newcomers to the trade were forced to establish quarries outside of Hants County in the hopes of finding new sources of rock. They were also successful in finding a new market and began shipping their product mostly to Quebec and Prince Edward Island. Hants County, however, continued to be the mainstay of Nova Scotia's production as 90 per cent of the Province's gypsum was still being exported from that area in the late 1800s.

*Plate 1. Atlantic Gypsum Products Ltd.'s gypsum quarry, Cheticamp, Inverness County, 1929.*

Small mining companies cropped up during this time and mills to manufacture finished gypsum products were established in the Province. The establishment of processing mills was the result of new-found uses for gypsum. Until 1900 gypsum was used principally as a land plaster (fertilizer) and as a filler in paints. After 1900 it was used for plaster of Paris in architectural and decorative work, because it was superior to the awkward lime plaster previously used. Another new market for gypsum was as a cement retarder to slow down the set of cement. However, a poor local demand for such products and a tariff imposed by the United States government on finished material entering that country forced the closure of these mills.

The gypsum industry in the Province continued to grow rapidly and first reached over one million tonnes production in 1939. In the mid 1900s production increased dramatically with the invention of wallboard, more commonly known as

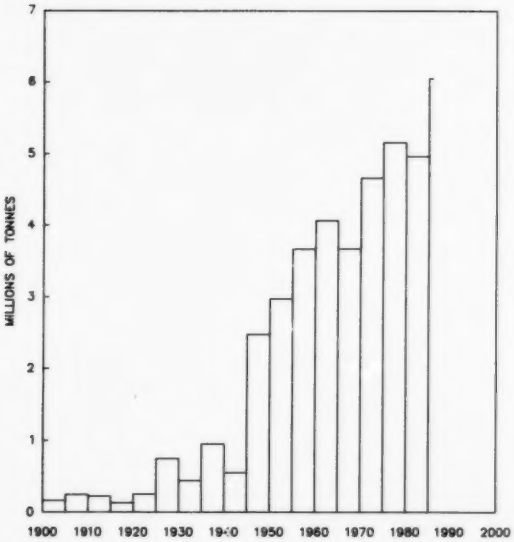



*Figure 2. Annual production of gypsum in Nova Scotia.*

gyprock. Unfortunately for the small producers, this industry success meant the downfall of minor operations. Due to the relatively low profit per tonne of gypsum the small companies gave way to the large producers. Also, through time and refined production techniques, employment in the industry has been affected dramatically. Today there are six companies mining gypsum in Nova Scotia, five less than were operating 75 years ago. The industry is now producing over five million more tonnes than in the 1920s, but employing 200 fewer.

## PRESENT DAY OPERATIONS

Six companies have gypsum and or anhydrite quarries in Nova Scotia, the largest being that of National Gypsum (Canada) Limited located at East Milford, Halifax County. National's 1986 production was over 2.8 million t from a single open-pit making it the largest gypsum producing quarry in the western world. Following crushing and screening, the stone is transported by unit train 42 km to port facilities at Wright's Cove near Halifax. Ocean going ships generally between 18 000 and 40 000 t capacity haul to the gypsum markets

in Central Canada and the Eastern United States from Portsmouth, New Hampshire, to New Orleans, Louisiana.

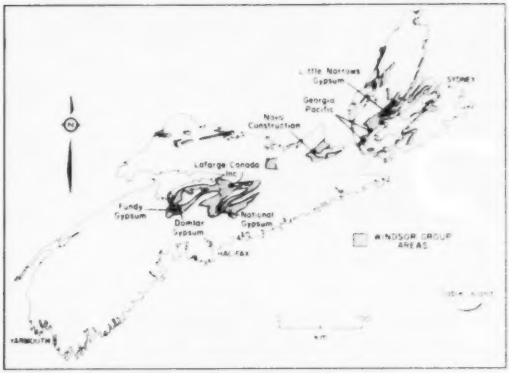



*Figure 3. Present day gypsum producers.*

Fundy Gypsum Company Limited, a subsidiary of U.S. Gypsum, produced 1.5 million t of stone from its two quarries near Windsor, Hants County, in 1986. Although most of their gypsum is wallboard grade stone, they also produce high purity white gypsum and anhydrite products. Their stone is moved by unit train 16 km to shipping facilities at Hantsport. These facilities are capable of loading at a rate of 6500 t per hour in order to cope with a 12 m tidal range at the dockside. Ocean going vessels take gypsum from Hantsport to various ports in the United States from Boston, Massachusetts, to Galena Park, Texas.

Little Narrows Gypsum Company Limited, another subsidiary of U.S. Gypsum, is located on tidewater at Little Narrows, Victoria County, on Cape Breton Island. Their 1986 production of 1.0 million t is noteworthy since operations are shut down for three months each year due to the freezing of Bras d'Or Lake. Stone is moved by conveyors onto ocean going ships for transport to various ports in Central Canada and along the Eastern Seaboard from Boston, Massachusetts to Houston, Texas. Little Narrows Gypsum is now developing a new quarry just east of its present production area.

Georgia-Pacific Corporation operates a quarry at Big Brook, Inverness County on Cape Breton Island. In 1986 they produced just under 0.8 million t of gypsum which was moved 32 km by unit

*Plate 2. National Gypsum (Canada) Ltd.'s East Milford quarry.*

train to loading facilities at Port Tupper. Georgia-Pacific has opened a new quarry at Sugar Camp, Inverness County, and is trucking the stone 11 km to docksite. A company owned ship carries the stone to Georgia-Pacific plants along the Eastern Seaboard.

Domtar Gypsum operates a small quarry and a calcining plant in the Windsor area, Hants County. This is the only gypsum processing plant in Nova Scotia. In 1986 about 11 000 t of stone were shipped from their quarry at MacKay Settlement, 24 km east of Windsor. Fine plaster products are shipped to markets mostly in Central Canada.

Lafarge Canada Inc. maintains a gypsum quarry in Brookfield, Colchester County, for their cement plant. Production is usually under 10 000 t per annum.

Nova Construction has recently developed a small high purity deposit at Brierly Brook, Antigonish County and produced 20 000 t in 1987.

## FUTURE DEVELOPMENT POTENTIAL

Potential for the development of additional gypsum and anhydrite deposits in the Carboniferous Windsor Group areas of Nova Scotia is excellent. Owing to the fact that gypsum is not defined as a mineral in the Province, the detailed information gathered by gypsum companies while exploring for new resources is not readily available. Ongoing investigations by the Nova Scotia Department of Mines and Energy are gathering information from surface exposures and subsurface data submitted by

companies involved in mineral exploration. These studies have identified a number of promising areas which require additional work to determine their true development potential.

## Gypsum

### Woodville, Hants County

Located approximately 15 km east-northeast of the Town of Windsor, the Woodville prospect straddles the Herbert River in central Hants County. Recent mapping in this area indicates that the gypsum deposit is part of Cycle 2 of the Windsor Group. Numerous gypsum outcroppings and well developed karst topography are typical over much of the area. No diamond-drill hole information is available consequently no tonnage estimate could be made. Transportation possibilities exist either through the port of Hantsport, which lies 25 km to the northeast, the port of Walton 25 km to the north or through Halifax 50 km to the south.

### Walton, Hants County

Walton, is located on the Minas Basin in the northern part of Hants County. Gypsum was produced from a series of small quarries in the area until 1970 and shipments were made from a wharf in the village. Significant areas of karst topography with minor outcrops can be found east and north of the previously worked areas. No drillhole information is available in this area therefore no attempt has been made to estimate tonnages of mineable gypsum.

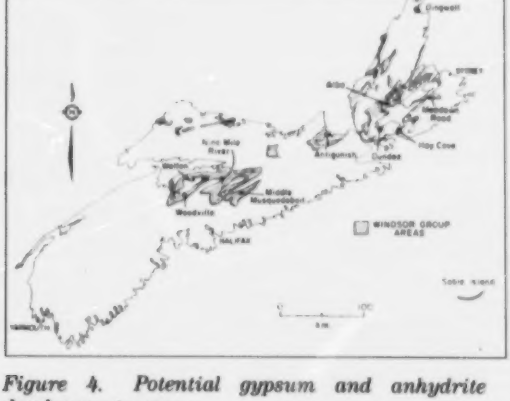



*Figure 4. Potential gypsum and anhydrite development areas.*

**Nine Mile River, Hants County**

Nine Mile River in eastern Hants County is also an area of good gypsum potential. Approximately 100 ha of karst topography with small outcrops indicate a significant amount of underlying gypsum in an area north of Uniacke Brook. This site is located about 45 km north of Halifax. No drilling has been reported in this area, however a few base metal exploration holes a short distance away indicate good thicknesses of gypsum in this area.

**Shubenacadie and Musquodoboit Basins**

Information on the Windsor Group strata from base metal exploration assessment reports indicates potential for deposits similar to National Gypsum's Milford quarry exists along the margins of both these sedimentary basins. Both the port of Halifax and newly constructed facilities at Sheet Harbour could serve these areas.

**Antigonish County**

Numerous gypsum occurrences are known in the vicinity of the Town of Antigonish, Antigonish County. The nearest shipping facility is located at the Strait of Canso 65 km to the east. Gypsum leases are held over much of this area by large gypsum producers.

**Alba, Inverness County**

Situated in northeastern Inverness County the Alba area is 10 km southwest of the Little Narrows Gypsum site. A base metal exploration drillhole encountered 47 m of gypsum here beneath only 18 m of overburden. Additional information on the area and its gypsum reserves has been gathered by a private company which is presently trying to sell its interests in the property. Shipments from Alba could be made by ship through Bras d'Or Lake or by rail to Port Hawkesbury at the Strait of Canso.

**Dundee, Richmond County**

Dundee is located on West Bay, Bras d'Or Lake in north central Richmond County. Base metal and celestite exploration drillholes in the area encountered interbedded gypsum, siltstone and limestone with gypsum thicknesses locally in excess of 30 m. Port Hawkesbury is only 25 km southwest of this area.

**Meadows Road, Cape Breton County**

Several shallow drillholes recently com-

pleted in the Meadows Road area, 15 km southwest of Sydney in Cape Breton County, have indicated significant potential for gypsum. Gently dipping beds could be amenable to underground mining.

### Anhydrite

Virtually all potential gypsum production sites in Nova Scotia are also potential anhydrite producers. Anhydrite bodies usually underlie the gypsum layers and in some instances are exposed at surface. Several past producing gypsum mine areas now lie inactive with large volumes of exposed, high purity anhydrite in the old quarry floors, especially the old quarries at Walton, Hants County and Dingwall, Victoria County. At St. Anns-Bevis Bay in Victoria County, just east of the Village of Baddeck, large volumes of high grade anhydrite are present with numerous outcroppings seen throughout the area.

## THE FUTURE OF NOVA SCOTIA'S GYPSUM INDUSTRY

Approximately 90 per cent of the gypsum and anhydrite shipped from Nova Scotia is destined for the United States. This situation remains unchanged after more than two centuries of gypsum production. Due to this reliance on the U.S. market, Nova Scotia's gypsum industry is subject to competition from other nations as well as alternate sources of gypsum such as phosphogypsum and flue gas desulphurization gypsum.

Although our shipments have been steadily increasing in the 1980s, our share of the U.S. market has declined. Spanish rock, for the most part, has been displacing Nova Scotia gypsum and anhydrite. Nova Scotia's gypsum and anhydrite industry, although strong, is currently facing some very stiff competition. Increased demand at the present time does not reflect the fact that other countries are cutting into the U.S. market. Only through tough competition will the industry be able to regain its market share.

Presently, more interest is being shown in developing the Province's secondary gypsum industry, a wallboard plant. Recent studies have indicated that the construction of such a plant may

now be viable in Nova Scotia. Certainly the next few years will be crucial to the gypsum industry. Established infrastructure, assured resources and a dedicated effort should be able to maintain Nova Scotia as a world leader in gypsum production.

## MINERAL RIGHTS

According to the Mineral Resources Act (1975) of Nova Scotia gypsum is not considered to be a mineral. In Nova Scotia gypsum is owned by the property owner of the land on which it occurs. In many other instances gypsum leases or rights are held.

Gypsum production is subject to a Provincial tax under the Gypsum Mining Income Tax Act. Anhydrite is considered to be a Crown Mineral in Nova Scotia and therefore is subject to regulation according to the Mineral Resources Act.

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